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10/593,243	09/19/2006	Pavel S. Gordienko	SAIC 22.755 (100788-00123)	7371
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EXAMINER				
CHAN, HENG M				
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

# Office Action Summary

**Application No.**

10/593,243

**Applicant(s)**

GORDIENKO ET AL.

**Examiner**

HENG M. CHAN

**Art Unit**

4181

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 19 September 2006.  
2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.  
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-21 is/are pending in the application.  
4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.  
5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.  
6) ☒ Claim(s) 1-21 is/are rejected.  
7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.  
8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.  
10) ☒ The drawing(s) filed on 19 September 2006 is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).  
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)  
2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)  
3) ☒ Information Disclosure Statement(s) (PTO/5508)  
Paper No(s)/Mail Date 09/19/2006  
4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_  
5) ☐ Notice of Informal Patent Application  
6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### **Status of Application**

Claims 1-21 are pending and presented for examination on the merit.

### ***Specification***

1. The abstract of the disclosure is objected to because it is not a single paragraph. Correction is required. See MPEP § 608.01(b).
2. The disclosure is objected to because of the following informalities:
  - Page 3, line 26 of the specification recites "tilter" which appears to be a misspelling of "filter."
  - Page 7, line 15 of the specification recites "far" which appears to be a misspelling of "for."
  - Page 7, line 24 of the specification recites "the first thermal hydrolysis reactor 25" and page 8, line 2-3 recites "the second thermal hydrolysis reactor 25." They cause confusion about whether 25 acts as both the first and second thermal hydrolysis reactors or it contains two reactors within itself.

Appropriate corrections are required.

### ***Claim Rejections - 35 USC § 112***

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. **Claims 1, 11, 13, and 19 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.**

5. The independent claim 1 fails to clearly set forth the steps comprised in the process. Steps (a), (b), (c), and (d) are suggested to be rewritten. For example, step (a) can be rewritten as "reacting a titanium ore containing iron with an aqueous  $\text{NH}_4\text{F}$  solution."

6. Claims 11, 13, and 19 are drawn to temperature ranges but are described with the phrase "up to." The term "up to" renders the claims indefinite because it is unclear whether the limitation following the phrase indicates the upper limit of the range. See MPEP § 2173.05(c).

***Claim Rejections - 35 USC § 102***

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. **Claims 1-4, 17-18, and 21 are rejected under 35 U.S.C. 102(b) as being anticipated by US Patent no. 2,042,435 to Svendsen.**

9. Regarding claim 1, Svendsen teaches the following:

- titanium-containing material such as ilmenite is treated with ammonium fluoride ( $\text{NH}_4\text{F}$ ) in either a dry form (see page 1, right column, lines 10-16) or an aqueous solution form (see page 4, right column, lines 55-60);
- dissolved titanium compounds are filtered from the insoluble portion (see page 5, left column, lines 10-15);
- the filtered solution of titanium compounds is subjected to hydrolysis by the action of water and ammonia to provide a hydrolyzed product, a hydrate (see page 7, right column, lines 32-36; page 6, left column, lines 46-51); and
- the hydrate is hydrated, dried, and then calcined at high temperatures to provide titanium dioxide (see page 7, right column, lines 48-53).

"Thermal hydrolysis" in the instant claim is interpreted as a decomposition reaction done in the presence of water or steam at elevated temperatures, which corresponds to the last step above in Svendsen's teaching.

Regarding claim 2, Svendsen teaches that the insoluble portion obtained from filtration consists largely of ferrous ammonium fluoride (see page 5, left column, lines 12-15; page 2, right column, equation 3).

Regarding claim 3, Svendsen teaches that the filtered ammonium fluoride solution contains the titanium diammino-tetrafluoride or other titanium tetrafluoride compounds (see page 5, left column, lines 47-51; page 2, right column, equation 3).

Regarding claim 4, Svendsen teaches that when ilmenite and excess of ammonium fluoride are mixed, the temperature is raised to above  $75^\circ\text{C}$  and preferably above  $100^\circ\text{C}$  –  $110^\circ\text{C}$  (see page 2, right column, lines 34-37).

Regarding claim 17, Svendsen teaches that the product of hydrolysis is hydrated by strong ammonia water and the resulted fluid suspension filters readily before calcination (see page 7, right column, lines 41-45).

Regarding claim 18, Svendsen teaches that the insoluble ferrous ammonium fluoride is separated from the titanium tetrafluoride solution by filtration (see page 5 or column 9, lines 10-15) and that the ferrous ammonium fluoride residue may be heated in a retort in the presence of oxygen or air and steam to volatilize and recover the ammonium fluoride and convert the ferrous fluoride into an iron oxide (see page 5, left column, lines 13-25).

Regarding claim 21, Svendsen teaches that titanium-containing materials, particularly titanium oxide minerals or compounds such as ilmenite and rutile, are used (see page 1, left column, lines 1-5).

### ***Claim Rejections - 35 USC § 103***

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. **Claims 6, 7-8, 19, and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent no. 2,042,435 to Svendsen as applied above.**

Regarding claim 6, Svendsen teaches that the mass from the reaction on the titanium-bearing material with ammonium fluoride is leached with an aqueous ammonium fluoride solution (hot or cold, neutral or slightly acidic) (see page 4, right column, lines 15-20).

Svendsen does not specifically teach a pH range of about 6.5 to 7 for step (a).

However, it would have been obvious to one of ordinary skill in the art to have provided the method of producing titanium dioxide as taught by Svendsen and performed step (a) of the claimed process using the ammonium fluoride solution in the pH range suggested by Svendsen, motivated by the fact that the ammonium fluoride solution in step (a) mostly likely determines the a pH of the reaction mixture in step (a) and that about 6.5 -7.0 falls within the taught pH range. Furthermore, it has been held that where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation. In re Aller, 220 F. 2d 454, 105 USPQ 233,235 (CCPA 1955).

Regarding claims 7 and 8, Svendsen teaches that the concentration of the solution of ammonium fluoride may vary widely, and may be from 16% to 50% or higher, preferably from 20% to 40% (see page 4, left column, lines 19-22).

Svendsen does not specifically teach that the aqueous  $\text{NH}_4\text{F}$  solution has a concentration of 30-60% or about 45% by weight.

However, it has been well settled in many court decisions that a *prima facie* case of obviousness is made when the prior art range is close to or overlap with the claimed range. It would have been obvious to one of ordinary skill in the art at time of invention

to have used an aqueous  $\text{NH}_4\text{F}$  solution of a concentration overlapping with or slightly different from those given by Svendsen, motivated by Svendsen's teaching that ammonium fluoride vaporizes during the course of the reaction, especially at elevated temperatures, and so the concentration of the aqueous solution of ammonium fluoride may vary even during the reaction, and that excess fluoride is not detrimental to the reaction (see page 2 or column 4, lines 17-24). (See MPEP § 2144.05 [R-5]).

Regarding claim 19, Svendsen teaches that the iron fluoride residue in the furnace after volatilization of the titanium tetrafluoride compounds therefrom may be treated by passing moist air over it while it is maintained at substantially the same temperature as is used during the volatilization of the titanium compounds (see page 7, right column, lines 55-60), which corresponds to a temperature above  $300^\circ\text{C}$  (see page 7, left column, lines 62-64).

Svendsen does not specifically state that the temperature for thermal hydrolysis is performed at a temperature of up to  $300\text{-}350^\circ\text{C}$ .

However, it has been well settled in many court decisions that a *prima facie* case of obviousness is made when the prior art range is close to or overlap with the claimed range. It would have been obvious to one of ordinary skill in the art at time of invention to have provided the method of making titanium dioxide as taught by Svendsen and added the step of performing the thermal hydrolysis reaction on the iron fluoride compounds at a temperature suggested by Svendsen, motivated by the fact that the skilled artisan would have wanted to maximize the production of pigments using the starting titanium ore containing iron and produce a red pigment from the iron fluoride



residue in addition to a white pigment from titanium dioxide. The skilled artisan would have also expected the same results from the thermal hydrolysis reaction of the iron fluoride residue done at a temperature of the prior art or claimed range. Therefore, a *prima facie* case of obviousness exists in this case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" (see MPEP 2144.05 [R-5]).

Regarding claim 20, Svendsen teaches that if a red pigment is desired, the iron fluoride residue obtained after removing the titanium compounds by volatilization is first decomposed at 400-450°C whereby the ammonium fluoride is volatilized, leaving the ferrous fluoride, which is then treated at 500-550°C with moist air (see page 9, right column, lines 23-27).

Svendsen does not specifically state that the iron fluoride compound is dehydrated and dried before subjected to thermal hydrolysis.

However, it would have been obvious to one of ordinary skill in the art at time of invention to have provided the method of making titanium dioxide and added the step of performing the thermal hydrolysis reaction on the iron fluoride compounds as taught by Svendsen and heated the iron fluoride residue near the suggested temperature range of 400-450°C before thermal hydrolysis, in order to produce a red pigment. At the suggested temperature range of 400-450°C, water would have been removed before the thermal hydrolysis reaction, which reads on the limitations of "dehydrated and dried before being subjected to said thermal hydrolysis" of the instant claim.

3.

4. **Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Svendsen as applied above, and further in view of US Patent no. 2,288,727 to Mayer et al.**

Regarding claim 5, Svendsen does not specifically teach the pressure conditions employed in the reaction between the titanium-containing material and ammonium fluoride.

Mayer et al., however, also drawn to treatment of titanium-bearing materials using ammonium fluoride, discloses that dilute  $\text{NH}_4\text{F}$  solutions, by evaporation of water vapor (steam) and  $\text{NH}_3$  fume at a pressure of from 2 to 10 atmospheres (corresponding to about 2-10 bars), reduces the rate of corrosion of cold rolled steel (see page 1, right column, lines 16-22).

Therefore, in regards to claim 5, it would have been obvious to one of ordinary skill in the art at the time of invention to apply pressure to the reaction of titanium-containing material with  $\text{NH}_3\text{F}$  as taught in Mayer et al., in the method of Svendsen, motivated by the fact that applying pressure enables the control of corrosion of the apparatus in commercial practice (see page 1, right column, lines 2-10) and the use of equipment made from the less expensive corrosion-resistant alloys and greatly increases the effective life of the equipment used in the process (see page 1, right column, 25-30).

5. **Claims 9, 10-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Svendsen as applied above, and further in view of US Patent no. 3,640,744 to Dietz et al.**

Regarding claim 9, Svendsen teaches that filter cake of hydrated titanium oxide (obtained after hydrolysis) is dried and calcined (see page 7, right column, lines 48-50).

Svendsen does not specifically teach that the drying and calcining were done in two reactors.

Dietz et al. relates to producing titanium dioxide pigments that are resistant to outdoor weathering involving the heating of pigmentary titanium dioxide prepared by vapor phase oxidation of titanium halides (see column 1, lines 39-46). Dietz et al. teaches that the typical temperatures at which titanium dioxide is dried range from about 60°C to about 300°C, usually range between 100° and 220°C, followed by calcination at a temperature typically ranging from about 800° to about 1200°C, and most commonly range from about 900° to about 1000°C (see column 2, lines 63-68).

It would have been obvious to one of ordinary skill in the art at time of invention to have performed the drying and calcination ("which read on the thermal hydrolysis reaction (d)") in two reactors, motivated by the fact that the two reaction steps as taught by Svendsen are conveniently managed in two reactors maintained at different temperature ranges disclosed by Dietz et al. Furthermore, since gaseous products such as ammonia and ammonium fluoride are generated, recovered, and recycled during various reactions in the process (Svendsen page 9, right column, lines 50-57), including the thermal hydrolysis reactions, the use of reactors enables the collection of these

gaseous compounds and reiterated use of these reagents and thus, increases efficiency, cost effectiveness, and industrial applicability.

Regarding claims 10-13, Svendsen teaches that the filter cake of hydrated titanium oxide (obtained after hydrolysis) is dried and calcined at a temperature about 900 °C to 1100°C (see page 7, right column, lines 48-50).

Svendsen does not specifically disclose the temperature at which the hydrolyzed titanium compound was dried.

Dietz et al. who relates to producing titanium dioxide pigments that are resistant to outdoor weathering involving the heating of pigmentary titanium dioxide prepared by vapor phase oxidation of titanium halides (see column 1, lines 39-46), teaches that the typical temperatures at which titanium dioxide is dried to avoid degradation of the pigment range from about 60°C to about 300°C, usually range between 100° and 220°C, followed by calcination at a temperature typically ranging from about 800° to about 1200°C, and most commonly range from about 900° to about 1000°C (see column 2, lines 63-68).

It would have been obvious to one of ordinary skill in the art at time of invention to have performed the thermal hydrolysis reaction in two reactors under the temperature conditions resulting from the combination of Svendsen and Dietz et al., motivated by the fact that it was well known in the art to dry the titanium product of a hydrolysis reaction and then calcine it at a higher temperature to produce titanium dioxide.

**6. Claims 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Svendsen as applied above, and further in view of US Patent no. 2,005,710 to Daudt et al.**

7. Regarding claim 14, Svendsen does not teach about the body of any reactor used for the thermal hydrolysis step.

8. However, Daudt et al., which relates to making fluorine derivatives of organic compounds in an apparatus involving hydrogen halides and elevated temperatures and pressures, teaches that the portions of the apparatus which come into contact with hydrogen halides and antimony pentahalide during the reaction have been ordinarily made of some corrosion-resistant material such as chromium alloy steels, chromium-nickel alloy steels (page 4, right column, lines 15-29).

9. It would have been obvious to one of ordinary skill in the art at time of invention to have provided the method of making titanium dioxide as taught by Svendsen with the thermal hydrolysis reactions that involve titanium fluoride compounds and elevated temperatures done in reactors made of chromium-nickel alloy as suggested by Daudt et al., motivated by the fact that it is known in the art that good results may be obtained in reactions involving corrosive fluorides, even at elevated temperatures and pressures, when materials of construction is corrosion-resistant; an example of such material is chromium-nickel-containing alloy (Daudt et al. page 4, right column, lines 25-29).

10.

**11. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Svendsen as applied above, and further in view of US Patent no. 4,652,438 to Folweiler.**

12. Regarding claim 15, Svendsen does not teach about the internal surface of any reactor used for the thermal hydrolysis step.

13. However, Folweiler, which relates to a chemical vapor purification process for preparing metal halides, more particularly, high purity metal fluorides, teaches that a particular inert and/or pure liner such as vitreous carbon coated graphite is used in the reactor (temperature capabilities of up to 800°C) in order to avoid recontaminating the purified fluoride product, and to prevent attack of the liner by the fluorides (see column 5, lines 63-67).

14. It would have been obvious to one of ordinary skill in the art at time of invention to have provided the method of making titanium dioxide as taught by Svendsen with the thermal hydrolysis reactions that involve titanium fluoride compounds and elevated temperatures done in reactors made of chromium-nickel alloy as suggested by Daudt et al. and lined the internal surface of a reactor with vitreous carbon as demonstrated by Folweiler, motivated by the fact that carbon, in the form of graphite or vitreous carbon, does not react with chlorine, bromine, or iodine; nor is carbon likely to react with the metals at the temperature involved (see Folweiler, column 3, lines 39-42). This is desirable because unwanted side reactions and products will be avoided and the reactor is preserved even in the presence of corrosive metal halides at high temperatures.

15.

**16. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Svendsen as applied above, and further in view of US Patent no. 4,803,056 to Morris et al.**

17. Regarding claim 16, Svendsen does not teach about the internal surface of any reactor used for the thermal hydrolysis step.

18. However, Morris et al., which also relates generally to a system for producing titanium dioxide from titanium tetrachloride vapors in a reactor, teaches that in one embodiment, the titanium tetrachloride first is heated and vaporized in a shell-and tube type heat exchanger operating at a temperature level of about 350°F (roughly 177°C) and then, the titanium tetrachloride is superheated to the first temperature level of above 1600°F (roughly 871°C) in a silica pipe type of heater in a reactor (see column 6, lines 11-16). Although the reactor is not lined with silica necessarily, the titanium tetrachloride is in contact with the inside of the pipe type heater, which resembles the situation in which the titanium fluoride compounds are in contact with the silica internal surface of a thermal hydrolysis reactor. Incidentally, the temperature at which Morris et al. heated the titanium tetrachloride is close to that of the second thermal hydrolysis reactor of the instant application.

19. Therefore, it would have been obvious to one of ordinary skill in the art at time of invention to have provided the method of making titanium dioxide as taught by Svendsen with the thermal hydrolysis reactions that involve titanium fluoride compounds and elevated temperatures done in reactors made of chromium-nickel alloy as

suggested by Daudt et al. and lined the internal surface of the second thermal hydrolysis reactor with silica, motivated by Morris et al.'s teaching that one silica pipe heater is useful for receiving the titanium tetrachloride at about 400°F (roughly 204°C) and for superheating the titanium tetrachloride at above 1600°F (or 871°C) (see column 6, lines 26-30).

20.

### ***Double Patenting***

21. Claims 1-21 of this application conflict with claims 1-21 of Application No. 11/852431. 37 CFR 1.78(b) provides that when two or more applications filed by the same applicant contain conflicting claims, elimination of such claims from all but one application may be required in the absence of good and sufficient reason for their retention during pendency in more than one application. Applicant is required to either cancel the conflicting claims from all but one application or maintain a clear line of demarcation between the applications. See MPEP § 822.

22. A rejection based on double patenting of the "same invention" type finds its support in the language of 35 U.S.C. 101 which states that "whoever invents or discovers any new and useful process ... may obtain a patent therefor ..." (Emphasis added). Thus, the term "same invention," in this context, means an invention drawn to identical subject matter. See *Miller v. Eagle Mfg. Co.*, 151 U.S. 186 (1894); *In re Ockert*, 245 F.2d 467, 114 USPQ 330 (CCPA 1957); and *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970).



A statutory type (35 U.S.C. 101) double patenting rejection can be overcome by canceling or amending the conflicting claims so they are no longer coextensive in scope. The filing of a terminal disclaimer cannot overcome a double patenting rejection based upon 35 U.S.C. 101.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to HENG M. CHAN whose telephone number is (571)270-5859. The examiner can normally be reached on Monday to Friday, 8:00 am EST to 5:30 pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vickie Kim can be reached on (571)272-0579. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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HMC  
/Vickie Kim/

Supervisory Patent Examiner, Art Unit 4181